

USDA
NATURAL RESOURCES
CONSERVATION SERVICE

MARYLAND CONSERVATION
PRACTICE STANDARD

NUTRIENT MANAGEMENT

CODE 590
(Reported by Acre)

DEFINITION

Managing the amount, source, placement, form and timing of the application of nutrients and soil amendments.

PURPOSES

This practice may be applied for one or more of the following purposes:

1. To budget and supply nutrients for plant production;
2. To properly utilize manure or organic by-products as a plant nutrient source;
3. To minimize agricultural non-point source pollution of surface and ground water resources;
4. To maintain or improve the physical, chemical and biological condition of soil.

**CONDITIONS WHERE PRACTICE
APPLIES**

This practice applies to all lands where plant nutrients and soil amendments are applied.

CONSIDERATIONS

Nutrient management planning relies heavily upon regular soil and manure testing using unbiased sampling techniques, setting realistic yield goals, using cover crops and/or crop rotations, and the timing and placement of plant nutrients.

The following items need to be considered when developing a nutrient management plan:

1. Evaluate existing site conditions, including soils, cropping systems, surface and subsurface water sources, and the presence of environmentally sensitive areas;
2. Consider water quality standards and designated use limitations that exist locally or statewide to protect the quality of water resources;
3. Consider the importance of soil tilth and organic matter content on plant nutrient absorption, root development, and water infiltration;
4. Consider the use of cover crops following crop harvest, where appropriate, to utilize and recycle residual nutrients and control soil erosion;
5. Consider the use of crop rotations and selection of crop varieties which enhance efficiency of nutrient uptake and improve soil and water resource conditions;
6. Consider the use of additional conservation practices that can reduce the transport and leaching of dissolved and attached nutrients, improve soil nutrient and water storage, and protect or improve water quality;
7. Consider the sources and forms of nutrients available for plant growth and production and how they affect the crop nutrient budget for the proposed crop and target yield;
8. Consider using pre-plant soil test information no older than one year when developing new nutrient management plans, particularly if animal manures or organic amendments are to be used as a nutrient source;
9. Consider induced deficiencies of nutrients due to excessive levels of other nutrients and the effect of soil pH on the availability of both soil and applied sources of plant nutrients and the optimum pH range of the crop to be grown;

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

10. Consider nitrogen volatilization losses associated with the land application of fertilizers and animal manures. Volatilization losses can become significant, if available nutrients are not incorporated into the soil in a timely manner after application;
11. Consider the potential problems from odors associated with the land application of animal manures or organic amendments, especially when applied near or upwind of residential or commercial properties;
12. Assess the effects of the seasonal water budget on nutrient balance and on potential loss from the plant environment to surface or ground water;
13. Evaluate the effects of water table management or controlled drainage on availability and movement of nutrients;
14. Consider nutrient application setback distances from environmentally sensitive areas, such as streams, water bodies, sinkholes, wells, gullies, ditches, surface inlets or rapidly permeable soil areas.

CRITERIA

General Criteria

Plans for nutrient management shall comply with all applicable Federal, state, and local laws and regulations.

Plans for nutrient management shall be developed in accordance with policy requirements of the NRCS General Manual Title 450, Part 401.03 (Technical Guides, Policy and Responsibilities) and Title 190, Part 402 (Ecological Sciences, Nutrient Management, Policy); technical requirements of the NRCS Field Office Technical Guide (FOTG); procedures contained in the National Planning Procedures Handbook (NPPH), the NRCS National Agronomy Manual (NAM) Section 503, and the Maryland Nutrient Management Manual (COMAR 15.20.07.03).

Persons who develop, review or approve plans for nutrient management shall be certified through the Maryland Department of Agriculture (MDA) Nutrient Management Certification Program (including reciprocity agreements) or a certification program acceptable to NRCS Mary-

land. (Refer to the Maryland Nutrient Management Regulations, COMAR 15.20.04 - Nutrient Management Certification and Licensing.)

Plans for nutrient management that are elements of a more comprehensive soil conservation and water quality plan shall recognize other requirements of the soil conservation and water quality plan and be compatible with its other requirements.

A crop nutrient budget for nitrogen, phosphorus, and potassium shall be developed that considers all potential sources of nutrients including, but not limited to animal manure and organic by-products, waste water, commercial fertilizer, crop residues, legume credits, and irrigation water.

Realistic yield goals shall be established based on soil productivity information, historical yield data, level of management and/or local research on similar soil, cropping systems, and soil and manure/organic by-products tests. Maryland Nutrient Management regulations require yield goals to be based on the average of the 3 highest-yielding years for the crop out of the latest consecutive 5-year cropping sequence. If yield information exists for more than 5 years for a given field or management unit, crop yield calculations may be based on the average of 60 percent of the highest-yielding years for all consecutive years that crop yield information is available. For new crops or varieties, industry yield recommendations may be used until documented yield information is available. (Refer to the Maryland Nutrient Management Regulations, COMAR 15.20.08 - Content and Criteria for Nutrient Management Plan Developed for an Agricultural Operation.)

Plans for nutrient management shall specify the form, source, amount, timing and method of application of nutrients on each field to achieve realistic yield goals, while minimizing nutrient (nitrogen and/or phosphorus) movement to surface and/or ground waters, or volatilization of nitrogen into the atmosphere.

The following application methods and timing shall be used as appropriate to reduce the risk of nutrients being transported to ground and surface waters, or into the atmosphere:

1. Using a Pre-Sidedress Nitrogen Test (PSNT) to determine nitrogen application rates;

2. Split applications of nitrogen to provide nutrients at the times of maximum crop utilization;
3. Avoiding winter nutrient application for spring seeded crops;
4. Banding nutrient applications, especially phosphorus near the seed row;
5. Applying nutrients uniformly to application areas (broadcast or banded), or as prescribed by precision agricultural techniques;
6. Timely incorporation of land applied manures or organic by-products; and,
7. Delaying field application of animal manures or other organic by-products if precipitation capable of producing runoff and erosion is forecast within 24 hours of the time of the planned application.

Erosion, runoff, and water management controls shall be utilized, as appropriate, to minimize pollution problems on fields that receive nutrients.

Waste management system planning, storage and treatment shall meet the need for application timing as well as land area requirements for proper waste utilization.

Soil Sampling and Laboratory Analysis (Testing)

Nutrient management planning shall be based on current soil test results developed in accordance with University of Maryland Cooperative Extension guidance and recommendations. Current soil tests are those that are no older than three years. (Refer to the Maryland Nutrient Management Manual.)

Soil samples shall be collected and prepared according to the University of Maryland Cooperative Extension guidance and recommendations (refer to the Maryland Nutrient Management Manual) or standard industry practice. Soil test analyses shall be performed by:

1. The University of Maryland Soil Testing Laboratory; or,

2. Laboratories whose soil test results are directly convertible to the University of Maryland Cooperative Extension's Fertility Index Value (FIV) scale.

Soil testing shall include analysis for any nutrients for which specific information is needed to develop the nutrient management plan.

Manure and Organic Amendment Testing

Nutrient values of manure and organic amendments shall be determined prior to land application based on laboratory analyses. Manure analyses will be conducted each time a manure storage is emptied for each manure source until a reliable trend of nutrient contents has been established for each manure source on each particular farm. Analyses will be performed through:

1. The University of Maryland Soil Testing Laboratory; or,
2. A testing laboratory whose techniques are consistent with the University of Maryland.

In those cases where a representative manure sample and analysis cannot be readily obtained, an NRCS and/or University of Maryland acceptable "book value" may be used for tentative planning purposes, only until an actual representative sample can be obtained and analyzed. Book values recognized by NRCS may be found in the Agricultural Waste Management Field Handbook, Chapter 4 – Agricultural Waste Characteristics.

Plant Tissue Testing

Tissue sampling and testing, where used, shall be conducted in conjunction with a current soil test and in accordance with University of Maryland Cooperative Extension guidelines and recommendations.

Field Risk Assessment

When the soil test phosphorus fertility index value (FIV) reaches the Maryland regulated threshold (currently set at equal or greater than FIV of 150), the Phosphorus Site Index (PSI), a field-specific assessment of the potential for phosphorus transport from the field, shall be used. (Refer to the Maryland Nutrient Management Manual.) When the soil test based FIV

threshold (FIV ≥ 150) has been reached, nutrient management plans shall include:

1. A record of the assessment rating for each field or sub-field; and,
2. Information about conservation practices and management activities that can reduce the potential for phosphorus movement from the site.

When such assessments are done, the results of the assessment and recommendations shall be discussed with the producer during the development of the nutrient management plan.

Phosphorus Site Index (PSI) Rating

Interpretation of the P loss rating determined by the Phosphorus Site Index (as described in the Maryland Nutrient Management Manual) is based on phosphorus loss potential due to site and transport characteristics (Part A) and phosphorus loss potential due to management practices and P source characteristics (Part B). Table 1 shall be used to interpret the P loss rating and to develop appropriate nutrient management plans, as required by Maryland Nutrient Management Regulations, COMAR 15.20.08.

Conservation practices that reduce surface runoff, subsurface flow, and erosion may be implemented to reduce the risk of phosphorus movement, thereby lowering the risk level from a higher category to a lower category.

Table 1. Interpretation of the Phosphorus Site Index Rating for Potential Phosphorus Loss.

Phosphorus Loss Rating	General Interpretation of the Rating
0 - 50	<p>LOW potential for P movement from this site, given current management practices and site characteristics. There is a low probability of adverse impact to surface waters from P losses from this site.</p> <p>Nitrogen-based nutrient management planning is satisfactory for this site.</p> <p>Soil P levels and P loss potential may increase in the future due to continued nitrogen-based nutrient management.</p>
51 - 75	<p>MEDIUM potential for P movement from this site, given current management practices and site characteristics. Implementation of conservation practices that reduce surface runoff, subsurface flow, and erosion shall be encouraged as appropriate to reduce the P loss potential.</p> <p>Nitrogen-based nutrient management, if used, shall be implemented no more than 1 year out of 3.</p> <p>Phosphorus-based nutrient management shall be implemented at least 2 years out of 3, during which time P applications shall be limited to the amount removed from the field by crop harvest, or the amount indicated by soil-test based P application recommendations, whichever is greater.</p>
76 - 100	<p>HIGH potential for P movement from this site, given current management practices and site characteristics.</p> <p>Phosphorus-based nutrient management planning shall be used for this site. Phosphorus applications shall be limited to the amount expected to be removed from the field by crop harvest, or the amount indicated by soil-test based P application recommendations.</p> <p>Implementation of conservation practices that reduce surface runoff, subsurface flow, and erosion shall be encouraged as appropriate to reduce the P loss potential.</p>
>100	<p>VERY HIGH potential for P movement from this site, given current management practices and site characteristics.</p> <p>No phosphorus shall be applied to this site. Implementation of conservation practices that reduce surface runoff, subsurface flow, and erosion shall be encouraged as appropriate to reduce the P loss potential.</p>

Nutrient Application Rates

Soil amendments shall be applied, as needed, to adjust soil pH to the specific range for optimum availability and utilization of nutrients. (Refer to the Maryland Nutrient Management Manual.)

Recommended nutrient application rates shall be based on University of Maryland Cooperative Extension recommendations that consider current soil test results, realistic yield goals and management capabilities. Rates of application are also dependent on the source of nutrients to be applied.

Inorganic/Commercial Fertilizer Applications - Planned nitrogen, phosphorus, and potassium application rates (developed as per the Maryland Nutrient Management Manual) shall not exceed the recommended rates established by the nutrient management plan for each field or management unit.

Starter Fertilizers - Starter fertilizers containing nitrogen, phosphorus and potassium shall be applied, as needed, in accordance with University of Maryland Cooperative Extension guidelines and recommendations. (Refer to the Maryland Nutrient Management Manual.) When starter fertilizers are used, they shall be considered in the overall crop nutrient budget and included in the nutrient management plan.

Manure/Organics Applications - Nutrient application rates shall be determined as follows:

1. **Nitrogen**. Planned nitrogen application rates shall not exceed the recommended rates established by the nutrient management plan (developed as per the Maryland Nutrient Management Manual).
2. **Phosphorus**. When the nutrient management plan is being implemented on a phosphorus standard (based on PSI results per Maryland Nutrient Management Manual), applied manure or other organic amendments shall not exceed the recommended rates of the phosphorus standard. An additional nitrogen application, from inorganic sources, may be needed to supply recommended amounts of nitrogen.

A single application of phosphorus applied as a manure/organic may be made at a rate equal to the recommended phosphorus application or estimated phosphorus removal in harvested plant biomass for the crop rotation or multiple years in the crop sequence. When such applications are made, the application rate shall:

- a. Not exceed the recommended nitrogen application rate during the year of application; or,
 - b. Not exceed the estimated nitrogen removal in harvested plant biomass during the year of application when there is no recommended nitrogen application.
 - c. Not be made on sites considered vulnerable to off-site phosphorus transport unless appropriate conservation practices, best management practices, or management activities are used to reduce the vulnerability.
3. **Potassium**. Excess potassium shall not be applied in situations in which it causes unacceptable nutrient imbalances in crops and forages.

Biosolids (Sewage Sludge) - Where non-farm organic waste (e.g. municipal sewage sludge) is to be utilized, recommended application rates will be determined by using University of Maryland Cooperative Extension recommendations. (Refer to the Maryland Nutrient Management Manual.) These materials must be applied as prescribed by federal, state or local regulations. Appropriate documentation of amounts applied must be maintained according to state regulations. The Maryland Department of the Environment (MDE) regulates the collection, handling, burning, storage, treatment, land application, disposal, and transportation of biosolids, treated biosolids, septage, or any product containing these materials which is generated or utilized in the State of Maryland.

Other Plant Nutrients - The planned rates of application for other nutrients shall be consistent with University of Maryland Cooperative Extension guidelines and recommendations. (Refer to the Maryland Nutrient Management Manual.)

Nutrient Application Timing and Methods

Timing and methods of nutrient application shall correspond as closely as possible with plant nutrient uptake characteristics, while considering cropping system limitations, weather and climatic conditions, and field accessibility. Nutrients shall not be applied to frozen, snow-covered, or saturated soil if the potential risk for runoff exists. (Refer to the Maryland Nutrient Management Manual.)

SPECIFICATIONS

Specifications shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose(s), using nutrients to achieve production goals and to prevent or minimize water quality impairment.

Nutrient Management Plans shall be developed in accordance with Maryland Nutrient Management Regulations, COMAR 15.20.07 – Agricultural Operation Nutrient Management Plan Requirements, and Maryland Nutrient Management Regulations, COMAR 15.20.08 – Content and Criteria for a Nutrient Management Plan Developed for an Agricultural Operation. The following components shall be included in the nutrient management plan:

1. Aerial photograph and soil map of the site;
2. Current and/or planned plant production sequence or crop rotation;
3. Results of soil, plant, water, manure or organic by-product sample analyses;
4. Realistic yield goals for the crops in the rotation;
5. Quantification of all nutrient sources, as well as ultimate fate/disposition;
6. Recommended nutrient rates, timing, form, and method of application and incorporation;
7. Location of designated sensitive areas or resources and the associated, nutrient management restriction;
8. Guidance for implementation, operation, maintenance, recordkeeping; and,

9. Complete crop nutrient budget for nitrogen, phosphorus, and potassium for the annual crop, crop rotation or crop sequence.

If increases in soil phosphorus levels are expected, nutrient management plans shall include:

1. The soil phosphorus levels at which it may be desirable to convert to phosphorus based implementation;
2. The relationship between soil phosphorus levels and potential for phosphorus transport from the field; and,
3. The potential for soil phosphorus draw down from the production, harvesting, and removal of crop biomass.

When applicable, plans shall include other practices or management activities as determined by specific regulation, program requirements, or producer goals.

A nutrient management plan shall include a statement that the plan was developed based on the requirements of the current standard and any applicable Federal, state, or local regulations or policies; and that changes in any of these requirements may necessitate a revision of the plan.

OPERATION AND MAINTENANCE

The owner/client is responsible for safe operation and maintenance of this practice including all equipment. Operation and maintenance shall address the following:

1. Periodic plan review to determine if adjustments or modifications to the plan are needed. At a minimum, plans will be reviewed and revised with each soil test cycle (3 years). More frequent reviews may be warranted and are encouraged if changes in the nutrient budget are desirable or needed for the next planned crop;
2. Protection of fertilizer and organic by-product storage facilities from weather and accidental leakage or spillage;
3. Calibration of application equipment to ensure uniform distribution of material at planned rates;

4. Documentation of the actual rate at which nutrients were applied. When the actual rates used differ from or exceed the recommended and planned rates by more than the parameters established by the Maryland Water Quality Improvement Act, records will indicate the reasons for the differences;
5. Maintaining records to document plan implementation. As applicable, records include:
 - a. Soil test results and recommendations for nutrient application;
 - b. Quantities, analyses and sources of nutrients applied;
 - c. Dates and method of nutrient applications;
 - d. Crops planted, planting and harvest dates, yields, and crop residues removed;
 - e. Results of water, plant, and/or organic by-product analyses; and,
 - f. Dates of review and person performing the review, and recommendations that resulted from the review.
8. The return, proper disposal or recycling of nutrient containers should be done according to state and local guidelines or regulations.

Records should be maintained for a minimum of three years; or for a period longer than three years if required by other Federal, state, or local ordinances, or program or contract requirements.

6. Workers should be protected from and avoid unnecessary contact with chemical fertilizers and organic by-products. Protection should include the use of protective clothing when working with plant nutrients. Extra caution must be taken when handling ammonia sources of nutrients, or when dealing with organic wastes stored in unventilated enclosures.
7. Rinsate material generated by the cleaning of nutrient application equipment should be handled properly. Excess material should be collected and stored or field applied in an appropriate manner. Excess material should not be applied on areas of high potential risk for runoff and/or leaching.

**SUPPORTING DATA AND
DOCUMENTATION**

The following is a list of the minimum data and documentation to be recorded in the case file:

1. Statement based on landowner/operator contact that a certified nutrient management plan has been prepared;
2. When applied and reportable, a statement based on landowner/operator contact that a certified nutrient management plan has been applied;
3. Where a certified nutrient management plan is a required component for program benefits, a minimum of a *Crop Recommendation Summary Sheet* is required. More specific documentation may be required, depending on program requirements.

REFERENCES

1. Maryland Department of Agriculture. *Maryland Nutrient Management Regulations*. COMAR 15.20.04 - 15.20.08.
2. Maryland Department of Agriculture, November 1999 (and as amended). *Maryland Nutrient Management Manual*.
3. USDA, Natural Resources Conservation Service, April 1992. *Agricultural Waste Management Field Handbook*.